

SINGLE-PASS LASER WELDING METHOD OF A T ASSEMBLY OF  
METALLIC PARTS

DESCRIPTION

Domain of the invention

The invention relates to the permanent attachment of a two or three-part metallic assembly in the shape of a "T" accessible only on one outside face. It is used particularly to assemble a thin, closed and partitioned shroud such as a vane placed in the fan duct, on the output side of the fan in a turbojet.

Prior art and problem that arises

The function of this type of vane is to stiffen the turbojet structure, particularly by creating a connection between two coaxial annular envelopes, and possibly to guide or deviate the cold air flow circulating in the fan duct. These vanes are metallic blades preferably composed of a hollow shroud inside which stiffener elements are placed. These shrouds are difficult to make and many operations are necessary, particularly for making primary parts and for making the assembly and the attachment such that the dimensions of the shroud are correct.

With reference to Figure 1, patent document FR 2 705 603 divulges a laser welding method for an assembly of two metallic parts in the form of a T. This method provides the means of making partitioned shrouds by fastening parts from the outside of the shrouds. A laser beam 8A, 8B is fired twice in

succession at an inclined angle, with the path intersecting at the outer surface 1B of the part 1 forming the head of the T assembly. The two axes of the laser weld 8A and 8B touch two top corners 2C of the part 2 acting as the stem of the T. The welding device is placed outside of the shroud, in other words on the side of the top surface 1B of the head 1 of the T.

Therefore, this method uses two successive passes of a laser beam each of which causes successive deformations.

It can be added that this type of assembly requires additional material in the form of filler wire, in order to prevent shape defects after welding. This is particularly applicable to roughness and various recesses and undercuts. Furthermore, the tooling investment is relatively expensive because parts need to be held in position with respect to each other continuously and the use of a filler wire unwinder. Finally, it is essential that the wire position should be controlled during welding.

Therefore, the purpose of the invention is to overcome these disadvantages.

## Summary of the invention

The main purpose of the invention is a laser welding method for the assembly of metal parts arranged in the shape of a T, the stem of the T being formed of a plate with parallel surfaces, the assembly only being accessible from the head side of the T, through an

external surface, the method comprising the following phases:

- T assembly of parts adjacent to each other,
- laser welding of the assembly through the outer  
5 surface of the T head, by two welds.

According to the invention, the two welds are made at the same time and are parallel to each other and perpendicular to the top surface of the head of the T, such that each of the two welding axes is tangent to  
10 one of the surfaces of the plate forming the stem of the T.

In one preferred embodiment of the invention, the two welds are made simultaneously with a bifocal welding head.

15 In a first embodiment of the assembly using the welding method according to the invention, the stem plate of the T is provided with tabs with a determined length and thickness, and the assembly includes a second part forming the head of the T with slots with  
20 length and thickness corresponding to the dimensions of the tabs on the stem plate of the T.

In this case, it is advantageous if the height H of the tabs is slightly more than the thickness of the second part of the assembly forming the head of the T.

25 In a second embodiment of the T assembly using the welding method according to the invention, the head of the T is formed of two plates perpendicular to the stem of the T and with their edge in contact with the stem plate.

List of figures

The invention and its various technical characteristics will be better understood after reading  
5 the following description of two embodiments of the invention. This description is accompanied by figures.

Figure 1, already described, is a section through an assembly using a welding method according to prior art.

10 Figure 2 shows an exploded isometric view of the first step in making an assembly according to a first embodiment of the invention.

Figure 3 shows an isometric view of the same assembly as in Figure 2, during the welding phase.

15 Figure 4 shows the assembly in Figures 2 and 3 once completed.

Figure 5 shows an isometric view of a second assembly to be welded using the welding method according to the invention.

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Detailed presentation of the two embodiments of the inventionFirst assembly

25 With reference to Figure 2, a first assembly that can be welded using the method according to the invention consists of two parts: a stem part 10 of the T and the head part 15 of the T. The stem part 10 is a rectangular plate with a determined thickness with tabs  
30 11 of a determined length and also spaced in a determined manner. Correspondingly, slots 16 are

formed in the head part 15 with a length and width corresponding to the length and width respectively of the tabs 11 in the stem part 10. With reference to Figure 3, it can easily be understood that the assembly  
5 consists of inserting the tabs 11 on the stem part 10 into the slots 16 in the head part 15.

A laser welding head 20 is placed vertically above the tabs 11 of the assembly. This laser welding head 20 is of the bifocal type, in other words it can emit  
10 two laser beams 21 parallel to each other. The laser welding head 20 is adjusted such that the two laser beams 21 are at a spacing equal to a given separation distance equal to the thickness of the stem part 10. In other words, each of the two laser beams is tangent to  
15 one surface of the stem part 10.

It is intended to cut the tabs 11 of the stem part and the slots 16 in the head part 15 by laser cutting, but other cutting methods could be used.

Therefore, welding on both sides of the top of the  
20 stem part 10 along and between the tabs 11 is done in a single pass by longitudinal displacement of the laser welding head 20.

The height of the tabs 11 is slightly more than the thickness of the head part 15 so that they project  
25 beyond it slightly. As shown in Figure 4, once welding is complete, these tabs 11 that supplied filler metal are transformed into slight bumps 12. The height of the welding seam after welding will increase as the height of the tabs 11 before welding increases.

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Second assembly

Figure 5 shows a second assembly that can be used to make the T using a laser welded attachment. A stem part 30 is still used, but without tabs. Two head parts 35D and 35G are placed in contact with the stem part 30, and near the top of it. They are fixed to it at one of their edges and therefore project from it perpendicularly. They are also in line with each other.

10 A bifocal weld, as described above for the previous assembly, can be used in exactly the same way, each of the two axes of the two laser beams 21 being parallel to a vertical face of the stem part 30, the weld being made along the entire length of the  
15 assembly.

The main advantage of the invention is that welding is done in a single pass without the need for any filler wire. The result is thus a weld seam without any shape defect and the risks of the assembly  
20 being deformed during the weld are minimized.